Chapter 1

Learn the Basics of Your Digital Video Camera

How to…

- Understand the uses and potential of digital video camcorders
- Select the best digital camcorder for your needs
- Understand the basic features of your camcorder
- Understand the differences between American and European video standards
- Operate the basic features of your camcorder
- Connect your camcorder to external equipment and computers

We live in a visual world. More than any other sense, vision dominates our culture. Visual media of all kind bombards us, from still images on billboards and in publications to television and movies. Nothing gives a person with a desire for creativity any greater sense of power than a video camera and the ability to "make movies." Digital video camcorders, with their capacity for editing on the home computer, enable us to move from the old and relatively crude level of home movies to finished and well-made visual records of events, personal and family history, business projects, and, of course, entertainment and art films. With a digital video camera, we can all be producers of exciting and fun video projects. Fortunately, as technology has expanded the availability and technological capability of digital video cameras and camcorders, their ease of use has also increased. Learning the basics will get you quite a way down the road toward the creation of far more creative and sophisticated video projects than you ever imagined.

Digital Video Cameras and Digital Video Camcorders

It is common, though misleading, to refer to a video camcorder both as a camcorder and video camera, and this will continue after this book, but let's take a moment to point out the difference between them. Basically, a *video camera* consists of:

- A lens
- A semiconductor device or image chip that converts the images concentrated by the lens to electrical signals
- A series of electronic circuits that process the electrical signals from the image chip into television signals that can be viewed on a TV screen or recorded by a video recorder or VCR

A *camcorder* is a video camera with a video recorder built into it. A *digital video camera* is a video camera that has additional electronic circuits added to convert the basic television signals (consisting of analog signals) into digital signals. A digital video camcorder also has a video recorder capable of recording digital rather than standard analog television signals.

From the beginning of television, both cameras and camcorders were analog devices. In the 1970s, digital audio and video were invented and began to find their way into television,

first as a means of adding special effects to programs, then as an editing device, and finally as cameras, camcorders, monitors, and view screens. Analog camcorders include VHS, SVHS, VHSC, 8mm, and Hi8 in consumer formats and many other professional formats. In the digital world, consumer formats include DV and Digital-8. I will explain these a bit more in the sections that follow.

NOTE

Analog signals are continuous electrical signals that vary in voltage and frequency. These signals are recorded to tape or disks as exact representations of those continuous signals. Digital technology records analog signals as a series of momentary "samples" of the voltage and frequency represented as a list of numbers. The human ear and eye perceive images and sound as continuous analog signals, so the digital signals that record audio and video must be converted back to analog to be displayed on a television or computer monitor for human viewing.

The camcorder is the typical video device that consumers and most professionals use to film video. You will probably encounter video cameras as attachments to your computer for capturing web video. I'll touch on these briefly in a later chapter, but this book will concentrate on the digital camcorder. Figure 1-1 shows a typical miniDV camcorder.

FIGURE 1-1 A typical miniDV camcorder

The DV Format

The most common consumer digital video format is the *DV* (*digital video*) format. This is a standard that has been adopted worldwide for consumer camcorders, recorders/VCRs, and other video devices. It uses a small cassette tape to record the signals and includes a certain standard for recording both audio and video signals so they can be properly exchanged between equipment from different manufacturers.

The Sony Digital-8 Format

Sony has developed a variation on the DV format that uses the same electronic and signal standards, but records the signal on a standard 8mm or Hi8 analog videocassette. The Digital-8 equipment also plays legacy analog 8mm and Hi8 tapes and can translate them into digital form when copying to other digital devices. Although this format is unique to Sony, the signal can be copied to and from DV equipment and can be interchanged in the process of editing on the computer. Sony also manufactures DV camcorders and equipment as well as a wide range of professional formats, both analog and digital.

International Video Standards

In the United States (and some other countries), a standard analog video signal consists of 525 lines and 30 frames per second. This standard is called the NTSC standard, for the National Television Standards Committee, which created it. In most of Europe, the standard is called PAL; this standard has 625 scanned lines and 25 frames per second. In France and a few other countries, there is a third standard called SECAM, which is similar to PAL. These standards are incompatible with one another. In other words, videotapes or broadcast signals in one format can't be viewed on TVs or VCRs that utilize the other formats. In addition, there are new high-definition analog and digital television standards that will be supplanting the existing standards over the next few years. For now, standard television and both DV and analog consumer camcorders use NTSC, PAL, or SECAM standards. In the United States, it will be NTSC exclusively. Unless you are exchanging tapes with friends overseas, you don't need to be concerned about these differences. If you do exchange tapes overseas, many video stores in large cities provide format conversion services. Most digital video editing systems can edit and output NTSC, PAL, and SECAM as well as many other digital formats if properly set. Analog monitors, recorders, and cameras cannot be switched.

Time Code

Time code is a function of camcorders that specifically identifies video frames and audio signals by time. In the recorded time code, each frame of visual and audio material has a unique identifier, or address. A time code consists of four two-digit numbers, which represent hours,

minutes, seconds, and frames on a 24-hour clock. In this way, frame-accurate, repeatable edits are possible. You can set and view time codes in the viewfinder of most camcorders and/or on the LCD readout on the side of the camcorder. These can be set and noted when you are shooting so that you can accurately rewind and return to shots or refer to them when editing. The time code is recorded on the DV tape and goes with the tape from camcorder to camcorder. Normal time code is called *non-drop-frame time code* and records the exact length of the video sequence. (Drop-frame time code is explained below.) Time code functionality is only available on high-end consumer (commonly called *prosumer*) and professional camcorders; most consumer models do not have true time code.

Drop-Frame Time Code

While the novice user may not need to use drop-frame time code, it is something more advanced users may want to consider. Generally, NTSC time code is considered to run at 30 frames per second. In reality, for a number of technical reasons, it actually runs at 29.97 frames per second. *Drop-frame time code* runs accurately at the 29.97 frames per second. This is accomplished by skipping or dropping frame numbers 00 and 01 at the beginning of each minute, except at the ten-minute mark. No actual video frames are dropped—only the respective frame numbers are omitted from the time code sequence. It is important for many editing purposes that you set the edit software to specify drop-frame time code. This is not a setting that is used on camcorder setups for consumer camcorders.

Technical Specifications for Consumer DV and Digital-8

There are a variety of technical specifications in use and many technical terms you're likely to encounter in your search for and use of a digital video camera. Rest assured, it's not necessary for you to understand each of the technical bits. I've included a list here of some terms you'll see, and these will be explained as we go, to the extent you need to know about them to use your digital camcorder effectively.

Video recording NTSC, PAL, or SECAM formats

Audio recording PCM digital sound, 16-bit (48 KHz with two channels), or 12-bit (32 KHz with two channels or 32 KHz with four channels simultaneously)

Tape formats miniDV or Digital-8

Tape speeds

SP .75 inches per second (18.81 mm per second)

LP .5 inches per second (12.56 mm per second)

Maximum recording time

SP 60 minutes with a 60-minute cassette

LP 90 minutes with a 60-minute cassette

DV outputs IEEE 1394, also called FireWire or I-Link (by Sony)

What to Look for When You're Buying a Digital Video Camera

Now that you know what the definitions and specifications of a digital video camcorder are, you will put down the book and run out to buy one, if you haven't already. Wait just a moment! There are a few things you might want to consider.

The quality of digital video or miniDV (the standard consumer digital format) camcorders is, at this point, very high. They are manufactured by a number of reputable companies, including Sony, Panasonic, JVC, Canon, and others. The three brands with the widest range of low-end consumer to professional models available in this format are Sony, Canon, and Panasonic. These companies are the leaders in professional video gear as well.

The best way to shop is to consider how you intend to use your camcorder. If you are going to use it only to record your vacation and the kids' birthdays, you might consider one of the inexpensive models. If you are making amateur movies or shooting weddings on the weekends, a mid-price to high-end model will be best.

Here are a few things to consider:

Still photos Many models come with built-in digital still cameras. Multiple-use devices always scare me. Neither feature ever seems as good as on the dedicated models. If you want to select a dual-use model, the ones that record still images onto memory sticks rather than to DV tape seem to give the best results and don't add wear and tear to the camcorder transport.

Color depth If you are doing professional work, you should consider a model with three CCD (charged coupled device) chips in the camera. This gives much greater color depth to the recorded images. This quality is essential if you are transferring video to professional settings. These cameras, of course, cost much more. The single CCD cameras are still virtually identical in image quality for typical home use.

External microphone The best camcorders allow for use of external microphones. This will allow you to avoid the slight whir caused by the internal microphone recording the transport noise. It will also allow for more accurate microphone placement when recording interviews and such. Distant microphone placement picks up more background noise and can mask spoken words.

Zoom The quality of optical zoom is much better than digital zoom. Most camcorders offer both, but make sure that you have at least a basic optical zoom. Go for a larger zoom

ratio (20x is better than 10x). If the camcorder you choose has both types of zoom, that's even better.

Image stabilization If you are going to do a lot of handheld shooting, consider a camcorder with image stabilization. This is a built-in circuit that records a fraction of a second of image ahead and compensates for camera jiggle. It is a remarkable feature. The smaller camcorders are almost useless without image stabilization or a tripod.

Batteries and accessories Compare battery life *and* battery cost when you are choosing a camcorder. An inexpensive camcorder can turn expensive fast when you go to buy extra batteries. The same consideration should be paid to accessories you might plan to buy. Check out both availability and cost of accessories, for example, extension lenses, remote control devices, etc., before you purchase the basic camcorder.

High-tech gadgets Low-light and infrared recording are neat features to experiment with, but they generally are only a novelty except for spies.

Using analog tapes If you have a Hi8 or 8mm analog camcorder and/or have a stash of legacy tapes, you might consider a Sony Digital-8 camcorder. The Digital-8 format can allow you to utilize those older tapes, transfer them to your computer, and mix shots with your Hi8 analog camcorder when you need a two-camera shot. The digital signals are completely compatible with standard miniDV and can be directly transferred to miniDV cassettes later with no loss of quality.

There are many other things you might consider in making your choice. Good sources of additional information are some of the excellent amateur and professional video magazines and the myriad of video-themed websites on the Internet.

Basic Operation of Your Camcorder

The main things you will want to do with your digital camcorder are tape, record, and play back video images and sound. Fundamentally, you do this by removing the lens cap, turning on the power, inserting a tape, pointing the camcorder at the subject, and pressing the Record button. I'll explain how to do these in more detail in the sections that follow.

Camcorder Features

This section will cover the key features commonly found on digital video camcorders. Specific features may or may not be found on a particular brand or model, and the control and specification will vary. When I was doing research for this book, I examined more than 25 camcorders and discovered that operation of some features, even very basic ones, is often not very "user friendly," and it was necessary to refer to user manuals. In light of this, please read the instruction booklet that accompanied your camcorder for specific details and operating instructions.

The Lens

The primary window of the video camcorder is the lens. A professional camcorder comes standard without a lens (which can cost as much as the camcorder itself). Most consumer camcorders come with a built-in lens that cannot be changed. One exception is the Canon XL1, which comes with a standard lens and can be fit with optional lenses. This camcorder can also be used with standard Canon 35mm film camera lenses with a special adapter. This and similar camcorders are designed for the prosumer markets and are frequently used by professionals because of their smaller size and light weight. In the basic consumer camcorder, you get what they provide, and the quality is generally good.

The lens directs light onto a *charged coupled device* (CCD), which is a semi-conductor chip that converts the light into electrical impulses that can be processed by the camcorder's circuitry. Low-end camcorders come with one CCD chip that processes all three primary colors. More expensive camcorders are equipped with three CCD chips and process the primary colors independently. The three-chip system results in higher quality images, which can be used more freely in professional and TV broadcast situations. While it is good to have the highest quality possible, the practical difference for amateur video is insignificant. Your video quality would be better served by buying a more expensive tripod than shelling out the extra money for three-chip camcorders.

In addition to color quality, CCD chips also offer a range of light sensitivity ratings, generally expressed in lux numbers. A *lux* is a metric measure of light levels. A higher number denotes a brighter light. Camcorders are best with the lowest possible lux number, which indicates that it will record images in situations with low light levels. This doesn't mean you can capture the highest quality video images in very low light, as the nature of low light creates an image that is most likely diffused and has indistinct shadows and modeling. Low-light shooting will record information and adequate video images. You still need to pay attention to good, adequate lighting when you are shooting high quality scenes.

Zoom lenses are standard on digital camcorders. Zoom lenses allow the operator to change the focal length of the lens from wide to narrow to record a shot with more in the picture (a wide shot) or a close-up on a particular subject (a narrow or tight shot). These lenses come in both optical and electronic zoom. Many camcorders are equipped with both. The optical zoom achieves the best quality result and should be used for high quality shots.

TIP

Use zoom sparingly as an effect. Be sure to practice before using it on important shots. Zoom at a constant speed and not too fast.

Setting the F-stop *F-stop* is a measure of how much light is being let through the lens. As in the human eye, the actual aperture that controls this is called the *iris*. Most lenses have marked settings ranging from *f*1.8 to *f*16. For example, an iris setting of *f*8 means that the lens is open to 1/8th of its total diameter. The smaller the f-stop number, the more light is passed through to the lens.

A rough technique for determining when there is enough light is to set the camera to auto-exposure or auto-iris. In this mode, the camera adjusts the iris automatically. Auto exposure tracks only the brightest part of the scene, so zoom out wide and pan around a bit (move the camera to take in more of the scene) to find an average reading. The iris setting should read about *f*5.6 or higher. An f-stop reading lower than *f*3.2 means the lens is almost totally open, taking in as much light as it can. This may result in a dark picture, loss of fine detail, colors not having rich saturation, and a reduced depth of field.

Setting the Depth of Field Depth of field is the range of distance, closer to or further away from the camera lens, within which objects in a scene are in focus. One of the factors in determining depth of field is the iris setting. Low f-stop (for example, *f*2) numbers produce a short depth of field, and larger f-stop (such as *f*16) numbers provide a greater depth of field. Another factor is focal length. When a lens is zoomed to a wider field of view, objects within the scene will be in focus over a greater depth of field. Similarly, when it is necessary to zoom in on a scene (narrow the field of view), especially in low light where the iris must be set to a low f-stop value, it will be more difficult to achieve good focus.

Should You Use Filters?

Lenses are normally built to hold filters, pieces of glass that have been tinted, treated, or designed to hold some material between the subject and the camera. The effects may be subtle or stunning, and are more "organic" than post-production effects added later. Effects include polarization, diffusion, fog, star pattern, and gradated colors. At the very least, always use a skylight or UV filter. These are important for two reasons. First, they cut down on ultraviolet light entering the camera, creating a bluish tinge in shadows. They also act as inexpensive protection for that very expensive lens, keeping dust, dirt, and fingerprints off the main glass.

TIP

When cleaning a lens, never blow on it. That just gets more dirt stuck down past the seals. Always use proper lens cleaning fluid and paper. And never, ever use alcohol, which can remove the special coatings on many lenses.

White Balance

A variety of features and controls can add greatly to the cost of a camera, but ultimately make a significant difference in convenience of operation and quality of results. One example is *white balance*. This is the way you tell the camera what type of light it is shooting in and, therefore, how it should render colors.

The human eye and brain are able to adjust and compensate in a variety of lighting conditions. Cameras just see what is there, in an objective electronic fashion. Different light sources, and lamps using different types of elements, produce different colors of light. Tungsten light is yellow, while fluorescent light is blue. Daylight is blue during high noon

on a cold November day, but orange at sunset in August. We refer to such different lights as being "cool" or "warm."

The ability to control the white balance produces colors that seem natural and avoids the bluish look of much home video. Even consumer camcorders come with simple lighting controls, often just "indoor" or "outdoor." High-end cameras allow you to set the white balance for a particular lighting setup. When you focus on a piece of white paper, the camcorder reads the degree of "warm" or "cool" and adjusts accordingly.

If you have a manual white balance control, it is also possible to fool the camcorder into accepting a different color scale for a special effect. For instance, by white balancing to a "cool" light source and then using tungsten lighting during the shoot, the video will be "warm"—that is, rich in yellows and oranges. These settings can also be stored for future use in similar circumstances.

The Eyepiece and/or Video Monitor

All camcorders are equipped with an eyepiece and/or a built-in video monitor screen, as shown in Figure 1-2. The eyepiece consists of a very small video screen, usually black and white, with a magnifying lens in front of it. This is designed to work like a standard film camera viewfinder for framing your shots and showing setup information as overlays on the screen (for example, "Record ON" and the time code). Many recent camcorders also have small built-in flat-screen color monitors for viewing playback or more easily viewing the scene being taped when the camera is mounted on a tripod. A third possibility is to use an external monitor plugged into the video output of your camcorder. Small monitors are available as accessories and attach to the hot-shoe clip on the top of the camcorder. Small portable TV sets with AV inputs are great for this purpose. I have a five-inch color Magnavox AC/battery-powered TV that serves this purpose well. It is also better for playback from the camcorder in the field because it has a bigger screen and a built-in speaker for the sound.

The Microphone

Virtually all camcorders come with a built-in stereo microphone, as shown in Figure 1-3. These are adequate for casual shooting, particularly when the camcorder is close to the sound being recorded (five or six feet maximum unless it is a concert or sporting event where the roar of the crowd is what you are after). For other applications, you will want to use an external microphone plugged into the external microphone input of your camcorder. If you are narrating while shooting, a head clip microphone or a microphone/headphone combination is excellent. For interviews, wireless or wired clip-on microphones are a good choice. Tabletop microphones or a cable from a public address mixer board is good when recording speeches or lectures. We will cover microphone selection and placement in Chapter 5.

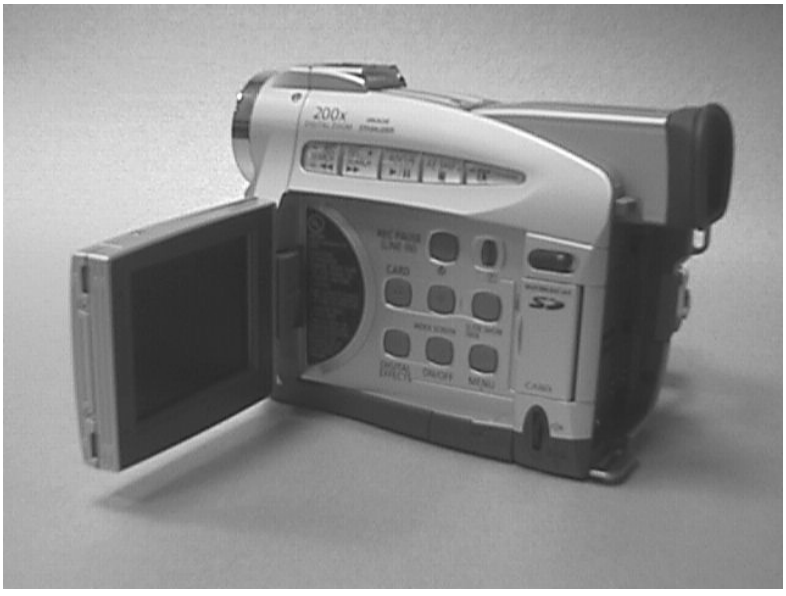

FIGURE 1-2 Close-up of on-camera monitor

FIGURE 1-3 Typical microphone

TIP

Most camcorders have no manual audio level controls, only automatic level settings. These will do fine. If you do have manual audio level controls, you will want to monitor the sound with a pair of headphones plugged into the headphone output jack while shooting to make sure the level is properly set.

The Video Recorder Transport

The *video recorder transport* (Figure 1-4) is the VCR record and playback mechanism and the control buttons that operate it. It functions in exactly the same way that you are used to on your home VCR or other similar device.

FIGURE 1-4 Close-up of transport cassette holder

The controls usually include Fast Forward, Forward, Play, Pause, Rewind, and Fast Rewind. Sometimes a red Record button is included. On most camcorders, this is a separate button on top as well as being associated with the Start and Stop buttons on the side grip of the camcorder.

Power Supply

Most camcorders come with both battery and external power sources. The external power sources often include direct connections to the camcorder to enable you to operate it without a battery and to charge the battery. Some camcorders come with both a power supply (see Figure 1-5) and a separate battery charger. Most camcorders also have optional fast chargers or multiple battery charging devices. Most camcorders can be optionally powered by car battery cables that plug into an automobile cigarette lighter or power outlet.

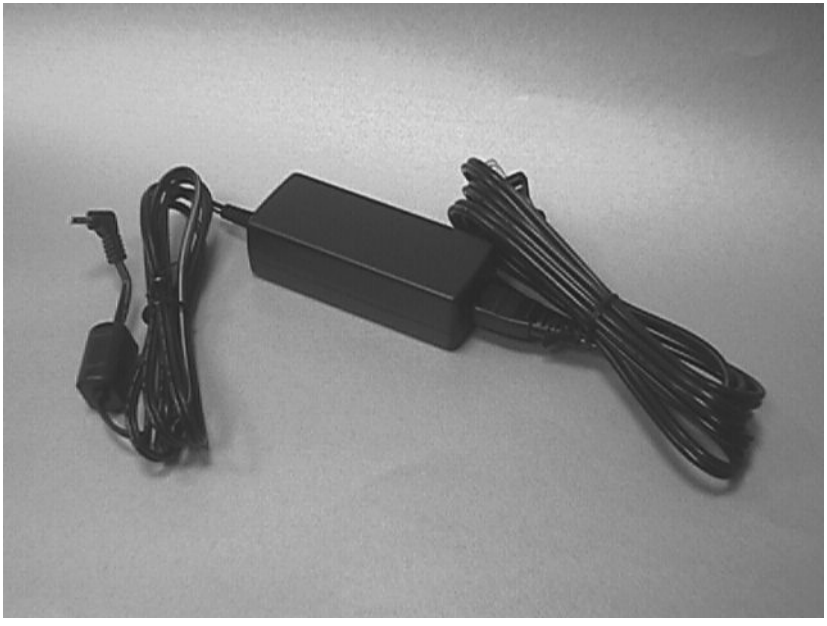

FIGURE 1-5 A typical power supply

Signal Input and Output Connectors

Camcorders come with a variety of additional jacks for plugging in external devices (see Figure 1-6). Some are inputs and some are outputs.

FIGURE 1-6 Typical input connectors

Input Connectors

Most camcorders have connectors for external microphones, usually mini-plugs for stereo microphones. Some are dual-function jacks, which accept external microphone signals as well as higher-powered signals from mixers, other camcorders, or VCRs. Better camcorders include three additional RCA jacks for video and audio inputs. These are usually color-coded red (right channel audio), white (left channel audio or monophonic), and yellow for composite video. DV camcorders usually also include S-Video (DIN) jacks for higher quality S-Video inputs. Some camcorders only have one set of jacks for input and output and determine which is in operation with a switch. A separate FireWire (I-Link or IEEE 1394) connector is also included for DV camcorders and usually functions as both input and output. FireWire ports carry both video and audio signals and other digital information, such as time code and titles. Some camcorders have external power jacks and other specialized connectors. Refer to your manual for these exceptions.

Output Connectors

Output connectors mirror the input connectors with the exception of the headphone jack, which is output only. As stated above, many camcorders supply only one set of jacks with a switch to change from input to output.

Become an Expert on Your Camcorder

It is important that you understand every aspect and feature of your camcorder. You should sit down and read your user manual from cover to cover. I carry mine in my camera case and refer to it often. Experiment with your camera and use every feature as described in the manual. Part of becoming a successful photographer means having the equipment become an extension of your body—you stop thinking of the camera as equipment and think of it as part of your vision. Finally, please remember that everything discussed in this book may be slightly different with your particular brand and model of camera.

Summary

Camcorders vary widely in features, nomenclature, and operating procedures. Check your instruction manual for details. The good news is that the quality of product is high and it is difficult to go wrong in product selection. Don't be afraid to use the trial and error process to learn how to operate your equipment. And have fun!